

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 1 114 970 A1**

(12)

EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(43) Date of publication:
11.07.2001 Bulletin 2001/28

(51) Int Cl.7: **F24F 7/08, F24F 11/02,
F24F 11/04**

(21) Application number: **99943320.4**

(86) International application number:
PCT/JP99/04997

(22) Date of filing: **13.09.1999**

(87) International publication number:
WO 00/16019 (23.03.2000 Gazette 2000/12)

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**

(72) Inventor: **TAKAHASHI, Takashi**
1304, Kanaoka Sakai-shi Osaka 591-8022 (JP)

(30) Priority: **14.09.1998 JP 26031198**

(74) Representative: **Steil, Christian, Dipl.-Ing. et al
Witte, Weller & Partner,
Postfach 10 54 62
70047 Stuttgart (DE)**

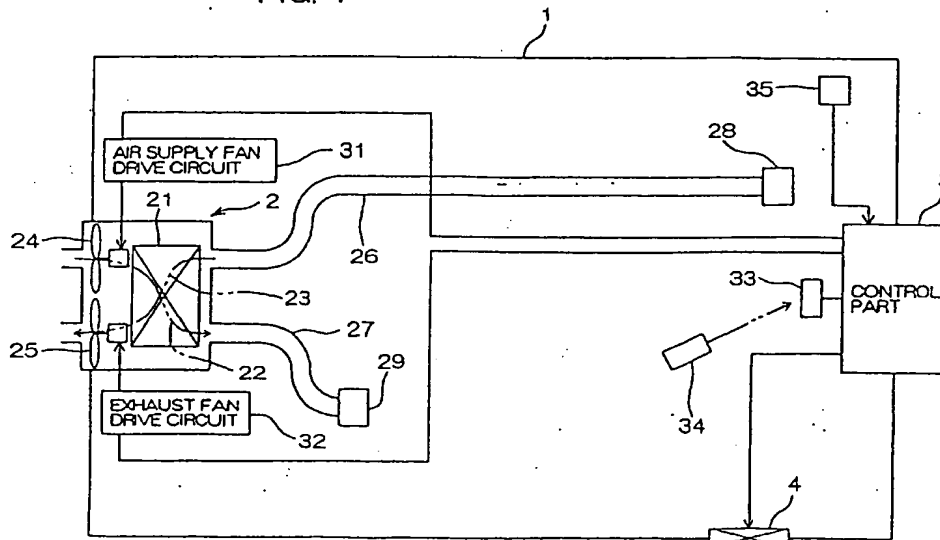
(71) Applicant: **Daikin Industries, Limited
Osaka-shi, Osaka 530-0015 (JP)**

(54) VENTILATING SYSTEM

(57) The present invention provides a ventilation system capable of varying the capacities of an air supply fan and an exhaust fan after installation. Drive circuits (31, 32) for driving the air supply fan (24) and the exhaust fan (25), respectively, are connected to a control part (3). Each of the drive circuits (31, 32) is provided with a tap for switching the blowing capacity of the air supply fan (24) and the blowing capacity of the exhaust fan (25), respectively, into a plurality of levels. Addition-

ally, a remote control receiver (33) is connected to the control part (3) so that signals for setting the operation mode of this ventilation system, which are outputted from a remote control transmitter (34), are inputted into the remote control receiver (33). The control part (3) switches the tap provided in each of the drive circuits (31, 32) according to the signals inputted from the remote control receiver (33), thereby driving the air supply fan (24) and the exhaust fan (25) at each capacity set by the user.

FIG. 1



Description

FIELD OF THE INVENTION

5 [0001] The present invention relates to a ventilation system installed in a construction such as a house and a building.

BACKGROUND OF THE INVENTION

10 [0002] Airtightness has been increased in recent houses due to heavy usage of aluminum sashes and improvements in construction methods. Above all, airtight houses in which the airtightness is particularly raised for the sake of air conditioning efficiency have been proposed by housing manufacturers. These airtight houses need to be provided with a ventilation system for forcibly introducing outside air into a room and exhausting air within the room from the room to the outside.

15 [0003] Conventionally, ventilation systems are equipped with a ventilation device including inside an air supply fan and an air exhaust fan. Each of the air supply fan and the exhaust fan is connected through a duct to an air inlet and an exhaust outlet, respectively, which are disposed, for example, in the ceiling of a living room, so that outside air is introduced through the air inlet into the living room while air inside the living room is exhausted through the exhaust outlet.

20 [0004] Blowing capacities of the air supply fan and the exhaust fan are set, during construction, according to the plan or the like of the room that is provided with the air inlet and the exhaust outlet. For example, when a toilet is located adjacent to the living room, the volume of air supply is set higher than the volume of exhaust so that the air pressure in the living room is higher than that in the toilet, thereby preventing the air (odor) of the toilet from flowing into the living room.

25 [0005] Meanwhile, the air supply-rich ventilation in which the volume of air supply is larger than the volume of exhaust is not necessarily preferable for ventilation of living rooms. For instance, there may be a situation in a living room in which one may want to have air contaminated with tobacco smoke promptly let out. In such a case, it is preferable to perform exhaust-rich ventilation in which the volume of exhaust is larger than the volume of air supply.

30 [0006] However, in the conventional ventilation systems, the capacities of the air supply fan and the exhaust fan preset during the construction could not be changed at the time of use. Accordingly, users were not able to freely switch the ventilating condition between air supply-rich ventilation and exhaust-rich ventilation according to the condition of the living room.

35 [0007] The volume of air supply and the volume of exhaust are determined not only by the capacities of the air supply fan and the exhaust fan, but also by the length and the girth of each duct extending from the air supply fan to the air inlet or extending from the exhaust outlet to the exhaust fan. Accordingly, even if the capacities of both fans are set equally upon installation for the sake of equality in volume between the air supply and the exhaust, such equality is not realized, if the air supply duct and the exhaust duct are different in length. For this reason, setting of the air supply fan and the exhaust fan during the construction tends to take time.

40 [0008] The problems described so far are not only of the ventilation systems installed in the airtight houses mentioned above, but shared commonly by ventilation systems for ordinary houses and buildings.

SUMMARY OF THE INVENTION

45 [0009] A primary object of this invention is to provide a ventilation system capable of freely changing blowing capacities of an air supply fan and an exhaust fan.

[0010] Another object of this invention is to provide a ventilation system that realizes comfortable air conditioning desired by the user.

[0011] The problems described above may be overcome by the invention according to claim 1.

50 [0012] The invention in claim 1 is a ventilation system for forcibly introducing outside air into a room and exhausting air within the room from the room to the outside, comprising an air inlet and an exhaust outlet disposed to face inside the room, an air supply fan for introducing outside air into the room through the air inlet, an exhaust fan for exhausting air within the room from the room to the outside through the exhaust outlet, capacity setting means for setting blowing capacities of the air supply fan and the exhaust fan, and control means for controlling drive of the air supply fan and the exhaust fan.

55 [0013] In the arrangement described above, the blowing capacities of the air supply fan and the exhaust fan can be freely set by the capacity setting means. Accordingly, the operating condition of the ventilation system can be switched into various operation modes including an air supply-rich operation in which the volume of air supply is larger than the volume of exhaust, an exhaust-rich operation in which the volume of exhaust exceeds the volume of air supply, a neutral operation in which the volume of air supply equals to the volume of exhaust, and so forth, by which appropriate

ventilation according to the condition of the room can be realized.

[0014] As in claim 2, the capacity setting means may include manual setting keys capable of separately setting each of the blowing capacities of the air supply fan and exhaust fan among a plurality of levels. Irrespective of the length and girth of each duct connecting the air supply fan to the air inlet or connecting the exhaust fan to the exhaust outlet, it is possible to select an operation mode from among the air supply-rich operation, the exhaust-rich operation and the neutral operation, by separately setting each of the blowing capacities of the air supply fan and the exhaust fan with these manual setting keys.

[0015] As in claim 3, the capacity setting means may include pattern selection keys for selecting one pattern from among a plurality of setting patterns available by combination of the blowing capacity of the air supply fan and that of the exhaust fan.

[0016] The pattern selection keys allow the user to select a desired pattern from among preset patterns without requiring separate setting of each blowing capacity of the air supply fan and the exhaust fan, thereby facilitating the operation.

[0017] In addition, as stated in claim 4, the capacity setting means may be provided with an extra-strong exhaust mode setting key. When the user wants to refresh air inside the room promptly or in some such cases, ventilation can be carried out immediately by operating the extra-strong exhaust mode setting key.

[0018] In order to improve the exhaust efficiency in the extra-strong exhaust mode, a supplementary ventilation fan may be included as in claim 5. The supplementary ventilation fan exhausts air from inside the room additionally to the ventilation by the air supply fan and the exhaust fan, the air inside the room can therefore be ventilated more promptly.

[0019] It is preferable for the ventilation system to have a heat exchange device according to claim 6, because when the room is being cooled or heated, it can prevent deterioration of the cooling or heating effect due to ventilation.

[0020] As in claim 7, heat exchange ventilation by using the heat exchange device or normal ventilation should preferably be selectable by switching, because in seasons such as spring and autumn when cooling or heating is not necessary, more efficient ventilation can be carried out by normal ventilation than by heat exchange ventilation.

[0021] As stated in claim 8, it is preferable to carry out normal ventilation when the extra-strong exhaust mode is set, because the normal ventilation provides ventilation efficiency better than that of the heat exchange ventilation so that exhaust in the extra-strong exhaust mode can be carried out more rapidly.

[0022] In addition to the manually operational setting keys mentioned above, the capacity setting means may be arranged as in claim 9 so as to include an automatic mode setting key for setting an automatic mode in which each of the blowing capacities of the air supply fan and the exhaust fan can be varied automatically. Each of the above-mentioned keys is not limited to a pressing type, but may be a sliding type or a rotational type.

[0023] As in claim 10, this system may also include a detecting sensor for detecting pollution degree of the air so that when the automatic mode is set, the blowing capacities of the air supply fan and the exhaust fan are automatically regulated based on detection outputs from the detecting sensor.

[0024] The detecting sensor for detecting pollution degree of the air may be a CO₂ sensor in claim 11 or a dust sensor in claim 12. In the system adopting the CO₂ sensor, for example, when there are many people within a room and the CO₂ concentration has increased due to exhaled air from the people, it is possible to increase the blowing volume of the air supply and the exhaust, or to switch to the exhaust-rich operation automatically. When adopting the dust sensor, it is possible for the system to automatically shift to the exhaust-rich operation when tobacco smoke or dust increases in the room.

[0025] The arrangement according to claim 13, in which the capacity setting means comprises a remote control device, allows users to switch the operation mode of the ventilation system freely from an arbitrary place in the room, which is convenient.

[0026] As discussed so far, this invention allows the user to operate the ventilation system in a desired condition, and provides a ventilation system that realizes comfortable air conditioning desired by the user.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Fig. 1 is a diagrammatic illustration of the structure of a ventilation system embodying this invention.

[0028] Fig. 2 is a plan view showing the structure of a remote control transmitter.

[0029] Fig. 3 is a flow chart showing a flow of control carried out by a control part.

[0030] Fig. 4 is a plan view of another structure of the remote control transmitter.

BEST MODE FOR CARRYING OUT THE INVENTION

[0031] Referring to the attached drawings, preferred embodiments of this invention are hereinafter described in detail.

[0032] Fig. 1 is a diagrammatic illustration of the structure of a ventilation system embodying this invention. This ventilation system is intended to be installed in a house such as an airtight house and to forcibly introduce outside air

into a room 1, and to forcibly exhaust air within the room 1 from the room to the outside.

[0033] This ventilation system comprises a heat exchange type ventilation device 2 housing a heat exchanger 21. The heat exchange type ventilation device 2 can perform heat exchange ventilation or normal ventilation by switching on an alternative basis. In the heat exchange ventilation, ventilation is carried out by crossing supply air and exhaust in the heat exchanger 21 so as to perform heat exchange between the supply air and the exhaust. The normal ventilation is carried out by making the exhaust from the room 1 bypass the heat exchanger 21 so as not to perform heat exchange between the supply air and the exhaust. An air supply path 22 and an exhaust path 23, which cross each other in the heat exchanger 21, are formed inside the heat exchange type ventilation device 2. An air supply fan 24 and an exhaust fan 25 are provided in the air supply path 22 and the exhaust path 23, respectively. Each one end of the air supply path 22 and exhaust path 23 is exposed to the outside from a wall such as an exterior wall of a house. Each of the other ends of the air supply path 22 and the exhaust path 23 is connected to an air inlet 28 through a duct 26, and to an exhaust outlet 29 through a duct 27, respectively, which air inlet 28 and exhaust outlet 29 being disposed in the ceiling of the room 1.

[0034] When the air supply fan 24 and the exhaust fan 25 are driven in this arrangement, the air (outside air) introduced from outside the house flows into the room 1 through the air supply path 22, the duct 26 and the air inlet 28, while the air within the room 1 is exhausted to the outside through the exhaust outlet 29, the duct 27 and the exhaust path 23.

[0035] The air inlet 28 and the exhaust outlet 29 are located approximately on a diagonal line of the room 1 with an appropriate interval therebetween.

Accordingly, the outside air introduced into the room 1 through the air inlet 28 is exhausted through the exhaust outlet 29 after going around a wide range of areas inside the room 1, by which the whole air inside the room 1 is efficiently ventilated.

[0036] The drive of the air supply fan 24 and the exhaust fan 25 is controlled by a control part 3 including CPU, RAM and ROM. More specifically, an air supply fan drive circuit 31 for driving the air supply fan 24 and an exhaust fan drive circuit 32 for driving the exhaust fan 25 are connected to the control part 3. The air supply fan drive circuit 31 and the exhaust fan drive circuit 32 are provided with taps for switching the blowing capacities of the air supply fan 24 and the exhaust fan 25 into a plurality of levels (for example, "extra-strong", "strong", and "weak"). Also, a remote control receiver 33 is connected to the control part 3 so that signals directed from a remote control transmitter 34 for setting the operation mode of this ventilation system are inputted into the remote control receiver 33. Additionally, a CO₂ sensor 35 for detecting CO₂ (carbon dioxide) inside the room 1 is connected to the control part 3. The control part 3 outputs driving signals to the air supply fan drive circuit 31 and the exhaust fan drive circuit 32 based on the signals inputted into it from the remote control receiver 33 and the CO₂ sensor 35 so as to switch the taps provided in each of the drive circuits 31 and 32, thereby controlling the drive of the air supply fan 24 and the exhaust fan 25.

[0037] A supplementary ventilation fan 4 disposed in the ceiling or a sidewall of the room 1 is also connected to the control part 3. This supplementary ventilation fan 4 functions only to exhaust the air from inside the room 1, and is controlled by the control part 3.

[0038] Fig. 2 is a plan view showing the structure of the remote control transmitter 34. The remote control transmitter 34 is provided with an operation key 51 for directing operation start/stop of the ventilation device 2, an air supply-switching key 52 for switching the air supply capacity of the air supply fan 24 into any of "extra-strong", "strong", and "weak" levels, and an exhaust switching key 53 for switching the exhaust capacity of the exhaust fan 25 into any of "extra-strong", "strong", and "weak" levels. Also, this remote control transmitter 34 has a group of indicators 54 for indicating the capacities of the fans 24 and 25, which are set by the air supply-switching key 52 and the exhaust-switching key 53.

[0039] It is also possible to omit the air supply-switching key 52 and the exhaust-switching key 53 and to provide each of the indicators in the group with a function of a key (switch) so that when the indicators in the group are selectively pressed, the capacities of the air supply fan 24 and the exhaust fan 25 are set according to the capacities indicated by the pressed indicators.

[0040] Furthermore, the remote control transmitter 34 is provided with an automatic mode key 55 for setting an automatic mode for automatically regulating the capacities of the air supply fan 24 and the exhaust fan 25 in accordance with the CO₂ concentration inside the room 1 (see Fig. 1), and an extra-strong exhaust mode key 56 for setting an extra-strong exhaust mode for rapidly exhausting the air from inside the room 1.

[0041] Fig. 3 is a flow chart showing a flow of control performed by the control part 3. When the operation key 51 is pressed by the user so as to direct this ventilation system to start operating (Step S1), the control part judges firstly whether the capacities of the air supply fan 24 and the exhaust fan 25 have been manually set or not (Step S2), that is, it judges whether the air supply-switching key 52 and/or the exhaust-switching key 53 have/has been operated by the user.

[0042] When either or both of the capacities of the air supply fan 24 and the exhaust fan 25 has/have been manually set by operating either or both of the air supply-switching key 52 and the exhaust-switching key 53, the fans 24 and

25 are driven at the capacity for each that has been set manually, and the ventilation system 2 starts the operation (Step S3).

[0043] On the other hand, when manual setting by the air supply-switching key 52 and the exhaust-switching key 53 has not been done, the program proceeds from Step S2 to Step S4 for judging whether the automatic mode key 55 has been pressed or not. If it is determined that the automatic mode key 55 has been pressed and the automatic mode for automatically regulating the capacities of the air supply fan 24 and the exhaust fan 25 has been set, the output of the CO₂ sensor 35 is checked so as to determine whether the CO₂ concentration inside the room 1 is not less than a predetermined concentration value (Step S5). If it is determined that the CO₂ concentration inside the room 1 is the predetermined value or more and therefore the air inside the room 1 is polluted, for instance, the air supply fan 24 is driven by the "strong" mode, while the exhaust fan 25 is driven by the "extra-strong" mode, thereby performing the exhaust-rich operation in which the volume of exhaust from the room 1 exceeds the volume of air supply introduced into the room 1 (Step S6). Thus, the polluted air or the air containing plenty of carbon dioxide inside the room 1 can be promptly exhausted without flowing into a space adjacent to the room 1.

[0044] When the CO₂ concentration is found less than the above mentioned predetermined value in Step S5, for example, the air supply fan 24 is driven by the "extra-strong" mode, while the exhaust fan 25 is driven by the "strong" mode so as to perform the air supply-rich operation in which the volume of air supply introduced into the room 1 exceeds the volume of exhaust from the room 1 (Step S7). This brings the air pressure inside the room 1 to be higher than that in the space adjacent to the room 1 so as to prevent odors and the like generated in the adjacent space such as a toilet from flowing into the room 1.

[0045] Additionally, the exhaust-rich operation to be carried out in Step S6 may be achieved by driving the air supply fan 24 by the "weak" mode while driving the exhaust fan 25 by the "strong" mode, or by driving the air supply fan 24 by the "weak" mode while driving the exhaust fan 25 by the "extra-strong" mode. Also, the air supply-rich operation to be carried out in Step S7 may be achieved by driving the air supply fan 24 by the "extra-strong" mode and driving the exhaust fan 25 by the "weak" mode, or by driving the air supply fan 24 by the "strong" mode while driving the exhaust fan 25 by the "weak" mode.

[0046] When the extra-strong exhaust mode key 56 is pressed to set the extra-strong exhaust mode with no manual setting nor pressing of the automatic mode key 55 having been done, either of the judgments in Step S2 and Step S4 is denied, and it is determined in Step S8 that the extra-strong exhaust mode has been set. In the extra-strong exhaust mode, the air supply fan 24 is driven by the "strong" mode with the exhaust fan 25 being driven by the "extra-strong" mode, as well as the supplementary ventilation fan 4 is driven (Step S9). Accordingly, in the extra-strong exhaust mode, the volume of exhaust from the room 1 increases further than that in the exhaust-rich operation in which the air supply fan 24 is driven by the "strong" mode with the exhaust fan 25 being driven by the "extra-strong" mode, so that the polluted air inside the room 1 is more rapidly exhausted.

[0047] When none of the air supply-switching key 52, the exhaust-switching key 53, the automatic mode key 55 and the extra-strong exhaust mode key 56 has been operated after the operation key 51 has been pressed in Step S1, any of the judgments in Step S2, Step S4 and Step S8 is denied. The program then proceeds from Step S8 to Step 10, where this ventilation system starts to operate in the mode that has been set in the operation immediately before the current operation (the last operation). That is, when the capacities of the air supply fan 24 and exhaust fan 25 have been manually set in the last operation, the air supply fan 24 and the exhaust fan 25 are driven at those manually set capacities. When the automatic mode or the extra-strong exhaust mode has been set in the last operation, this ventilation system is operated according to the last set mode. Meanwhile, the mode selected in the operation immediately before the current operation has been memorized in memory such as RAM housed in the control part 3.

[0048] During the operation of the ventilation system, whether the operation stop of the ventilation system 2 has been directed by operating the operation key 51 or not is repeatedly judged (Step S11). The program returns from Step S11 to Step 2 so as to repeatedly carry out the procedure starting from Step S2 described above until the operation stop of the ventilation system 2 is directed. Accordingly, in the case, for example, where the manual setting is once done and the automatic mode or the extra-strong exhaust mode is selected afterwards, the program proceeds from Step S2 to Step S4 so as to operate the system in the newly set mode. Meanwhile, when the air supply-switching key 52 and/or the exhaust-switching key 53 have/has been operated during operation in the automatic mode or the extra-strong exhaust mode, the air supply fan 24 and/or the exhaust fan 25 are/is driven at the capacity for each that has been newly set manually. When either the air supply-switching key 52 or the exhaust-switching key 53 has been operated, the one that has not been operated is driven at the capacity set in the last operation. Finally, when the user presses the operation key 51 so as to direct this ventilation system to stop the operation, the drive of both the ventilation device 2 and the supplementary ventilation fan 4 is stopped (Step S12), thereby completing this process.

[0049] As discussed so far, this embodiment allows the user to modify each of the capacities of the air supply fan 24 and exhaust fan 25 separately by operating the air supply-switching key 52 and the exhaust-switching key 53 provided in the remote control transmitter 34. Accordingly, unlike the conventional ventilation systems where the operation mode has been fixed to be either an air supply-rich mode or an exhaust-rich mode, this embodiment can carry

out appropriate ventilating operation in accordance with the condition inside the room 1.

[0050] Also, by setting each of the capacities of the air supply fan 24 and the exhaust fan 25 separately irrespective of the length and the girth of each of the ducts 26 and 27, this system can surely perform the air supply-rich operation, the exhaust-rich operation or the neutral operation in which the volume of air supply from the air inlet 28 equals to the volume of exhaust from the exhaust outlet 29. Thus, unlike the ventilation systems of the conventional kind, this system can be prevented from being kept operating in an unwanted mode.

[0051] Additionally, this embodiment includes an automatic mode for automatically regulating the capacities of the air supply fan 24 and the exhaust fan 25 so that with this mode set, the operation mode of this ventilation system is automatically switched between the air supply-rich operation and the exhaust-rich operation based on the output from the CO₂ sensor 35. This enables the ventilating operation to have further improved efficiency, as well as enables the user to save the trouble for manually setting the capacities of the air supply fan 24 and the exhaust fan 25.

[0052] In the discussion above, an embodiment having a CO₂ sensor 35 as a detecting sensor has been described. However, the detecting sensor may be a sensor other than the CO₂ sensor such as a dust sensor capable of detecting dust particles in the air. The dust sensor is disposed, for example, in the vicinity of the exhaust outlet 29. The air to be exhausted from the exhaust outlet 29 is air that has moved around the inside of the room 1. Accordingly, if the air inside the room 1 is polluted with dust and the like, the air in the vicinity of the exhaust outlet 29 is also polluted. The dust sensor therefore detects dust in the air passing here.

[0053] The dust sensor comprises, for instance, a light-emitting element and a light-receiving element being arranged such that the light emission volume can be detected by the light-receiving element. When making the air to be exhausted pass between the light-emitting element and the light-receiving element, the quantity of the light received by the light-receiving element decreases when the air to be exhausted is polluted. Thus, the pollution degree of the air can be detected according to the quantity of the light received by the light-receiving element. Such a dust sensor has already been publicly known.

[0054] It is also possible to adopt such a dust sensor so as to deliver outputs of the dust sensor to the control part 3, thereby switching the blowing capacities of the air supply fan 24 and exhaust fan 25. For instance, when the air inside the room 1 is polluted, the blowing capacity of the exhaust fan 25 is raised and the blowing capacity of the air supply fan 24 is modified to be somewhat lower than that of the exhaust fan 25. Or, the supplementary ventilation fan 4 may be driven according to need.

[0055] Furthermore, this embodiment includes an extra-strong exhaust mode that performs exhaust-rich operation in which the air supply fan 24 is driven in the "strong" mode with the exhaust fan 25 being driven in the "extra-strong" mode, while driving the supplementary ventilation fan 4. This enables prompt ventilation between the air inside the room 1 polluted with tobacco smoke or the like and fresh air from the outside.

[0056] An embodiment of this invention has been explained so far. However, this invention is not intended to be limited to the embodiment above. For example, although the above embodiment is arranged so as to allow each of the capacities of the air supply fan 24 and the exhaust fan 25 to be manually set separately, another embodiment may be provided with a plurality of setting patterns available by combination of the capacity of the air supply fan 24 and that of the exhaust fan 25 so that the user can select a desirable pattern from among those patterns.

[0057] As shown in Fig.4, a remote control transmitter 34A is provided with pattern selection keys 61, 62, 63, 64, 65 and 66 for selecting any one from among "strong" or "weak" neutral operation, "strong" or "weak" exhaust-rich operation, and "strong" or "weak" air supply-rich operation. By pressing any one of these pattern selection keys 61-66, the user can select the capacities of the air supply fan 24 and the exhaust fan 25 set for each pattern. The capacities of the air supply fan 24 and the exhaust fan 25 for each setting pattern are shown in Table 1 below.

Table 1

Setting pattern		Air supply fan	Exhaust fan
Neutral operation	Strong	Strong	Strong
	Weak	Weak	Weak
Exhaust-rich operation	Strong	Strong	Extra-strong
	Weak	Weak	Strong
Air supply-rich operation	Strong	Extra-strong	Strong
	Weak	Strong	Weak

[0058] Meanwhile, when the extra-strong exhaust mode is set in the above-described embodiment, the system performs the exhaust-rich operation in which the volume of exhaust exceeds the volume of air supply, while driving the

supplementary ventilation fan 4. Instead of or in addition to the above described arrangement, when the extra-strong exhaust mode is set, it is possible to drive the air supply fan 24 and the exhaust fan 25 in such a manner that the volume of exhaust surpasses the volume of air supply, as well as to make the heat exchange type ventilation device 2 perform normal ventilation. This is because exhaust can be more smoothly carried out since the exhaust from the room 1 does not pass through the heat exchanger 21 in the normal ventilation.

[0059] Incidentally, in cases other than the above modification in which the heat exchange type ventilation device 2 is made perform normal ventilation in the extra-strong exhaust mode, the heat exchange type ventilation device 2 can be duly switched between the heat exchange ventilation and the normal ventilation according to the setting of the user and the season.

[0060] Although it is stated in the case of the embodiment above that this ventilation system is installed in an airtight house, it may also be installed in houses other than airtight houses, or buildings such as offices, hospitals, nursing homes, and schools.

[0061] In addition, various modifications in design are possible within the scope of the technical matters stated in the claims.

Claims

1. A ventilation system for forcibly introducing outside air into a room and forcibly exhausting air within the room from the room to the outside, comprising:

an air inlet (28) and an exhaust outlet (29) being disposed to face inside said room;
 an air supply fan (24) for introducing outside air into said room through said air inlet (28);
 an exhaust fan (25) for exhausting air within said room to the outside through said exhaust outlet (29);
 capacity setting means (34) for setting blowing capacities of said air supply fan (24) and said exhaust fan (25);
 and
 control means (3, 31, 32) for controlling drive of said air supply fan (24) and said exhaust fan (25) based on the contents set by said capacity setting means (34).

2. The ventilation system according to claim 1, wherein said capacity setting means (34) includes manual setting keys (52, 53) capable of separately setting each of the blowing capacities of said air supply fan (24) and said exhaust fan (25) among a plurality of levels for each fan.
3. The ventilation system according to claim 1 or 2, wherein said capacity setting means (34) includes pattern selection keys (61, 62, 63, 64, 65, 66) for selecting one pattern from among a plurality of setting patterns available by combination of a blowing capacity of said air supply fan (24) and a blowing capacity of said exhaust fan (25).
4. The ventilation system according to any one of claims 1 to 3, wherein said capacity setting means (34) includes an extra-strong exhaust mode setting key (56) for setting an extra-strong exhaust mode which is a drive mode for promptly ventilating air inside said room.
5. The ventilation system according to claim 4 further comprising a supplementary ventilation fan (4) provided for additionally exhausting air from inside said room to the outside, whose drive being controlled by said control means (3),
 wherein with said extra-strong exhaust mode being set, said control means (3) drives said air supply fan (24) and said exhaust fan (25) such that the volume of exhaust from said exhaust outlet (29) surpasses the volume of air supply from said air inlet (28), while driving said supplementary ventilation fan (4) at the same time.
6. The ventilation system according to any one of claims 1 to 5, comprising a heat exchange device (21) for performing heat exchange between the outside air introduced into the room and the exhaust from inside the room.
7. The ventilation system according to claim 6, wherein said ventilation system is capable of performing ventilation by alternatively switching the operation between heat exchange ventilation by way of said heat exchange device (21) and normal ventilation with not using said heat exchange device (21).
8. The ventilation system according to claim 7, wherein said control means (3) controls the drive so as to perform the normal ventilation when said extra-strong exhaust mode is set.

9. The ventilation system according to any one of claims 1 to 8, wherein said capacity setting means (34) includes an automatic mode setting key (55) for setting an automatic mode for automatically varying the blowing capacity of said air supply fan (24) and the blowing capacity of said exhaust fan (25).
10. The ventilation system according to claim 9 further comprising a detecting sensor (35) for detecting pollution degree of air inside said room,
wherein with an automatic mode being set by said capacity setting means (34), said control means (3) automatically regulates the blowing capacities of said air supply fan (24) and said exhaust fan (25) based on outputs of said detecting sensor (35).
11. The ventilation system according to claim 10, wherein said detecting sensor (35) includes a CO₂ sensor for detecting CO₂ in the air.
12. The ventilation system according to claim 10, wherein said detecting sensor (35) includes a dust sensor for detecting dust particles in the air.
13. The ventilation system according to any one of claims 1-12, wherein said capacity setting means (34) is a remote control device which outputs remote control signals, and said control means (3) includes a receiving part (33) for receiving the signals from the remote control device.

Amended claims under Art. 19.1 PCT

1. A ventilation system for forcibly introducing outside air into a room (1) and forcibly exhausting air from within the room (1) to the outside, comprising:

an air inlet (28) and an exhaust outlet (29) being disposed to face inside said room (1);
an air supply fan (24) for introducing outside air into said room (1) through said air inlet (28);
an exhaust fan (25) for exhausting air within said room (1) to the outside through said exhaust outlet (29);

characterized by

capacity setting means (34; 34A) for setting blowing capacities of said air supply fan (24) and said exhaust fan (25); and
control means (3, 31, 32) for controlling drive of said air supply fan (24) and said exhaust fan (25) based on the contents set by said capacity setting means (34).

2. The system of claim 1, characterized in that said capacity setting means (34) includes manual setting keys (52, 53) capable of separately setting each of the blowing capacities of said air supply fan (24) and said exhaust fan (25) among a plurality of levels for each fan (24, 25).

3. The system of claim 1 or 2, characterized in that said capacity setting means (34A) includes pattern selection keys (61, 62, 63, 64, 65, 66) for selecting one pattern from among a plurality of setting patterns available by combination of a blowing capacity of said air supply fan (24) and a blowing capacity of said exhaust fan (25).

4. The system of any one of claims 1 to 3, characterized in that said capacity setting means (34; 34A) includes an extra-strong exhaust mode setting key (56) for setting an extra-strong exhaust mode which is a drive mode for promptly ventilating air inside said room (1).

5. The system of claim 4, characterized by a supplementary ventilation fan (4) provided for additionally exhausting air from inside said room (1) to the outside, whose drive being controlled by said control means (3),
wherein with said extra-strong exhaust mode being set, said control means (3) drives said air supply fan (24) and said exhaust fan (25) such that the volume of exhaust from said exhaust outlet (29) surpasses the volume of air supply from said air inlet (28), while driving said supplementary ventilation fan (4) at the same time.

6. The system of any one of claims 1 to 5, characterized by a heat exchange device (21) for performing heat exchange between the outside air introduced into the room (1) and the exhaust from inside the room (1).

7. The system of claim 6, characterized in that said ventilation system is capable of performing ventilation by alternatively switching the operation between heat exchange ventilation by way of said heat exchange device (21) and normal ventilation with not using said heat exchange device (21).

8. The system of claim 7, characterized in that said control means (3) controls the drive so as to perform the normal ventilation when said extra-strong exhaust mode is set.

9. The system of any one of claims 1 to 8, characterized in that said capacity setting means (34; 34A) includes an automatic mode setting key (55) for setting an automatic mode for automatically varying the blowing capacity of said air supply fan (24) and the blowing capacity of said exhaust fan (25).

10. The system of claim 9, characterized by a detecting sensor (35) for detecting pollution degree of air inside said room (1),

wherein with an automatic mode being set by said capacity setting means (34), said control means (3) automatically regulates the blowing capacities of said air supply fan (24) and said exhaust fan (25) based on outputs of said detecting sensor (35).

11. The system of claim 10, characterized in that said detecting sensor (35) includes a CO₂ sensor for detecting CO₂ in the air.

12. The system of claim 10, characterized in that said detecting sensor (35) includes a dust sensor for detecting dust particles in the air.

13. The system of any of claims 1 to 12, characterized in that said capacity setting means (34; 34A) is a remote control device which outputs remote control signals, and said control means (3) includes a receiving part (33) for receiving the signals from the remote control device.

FIG. 1

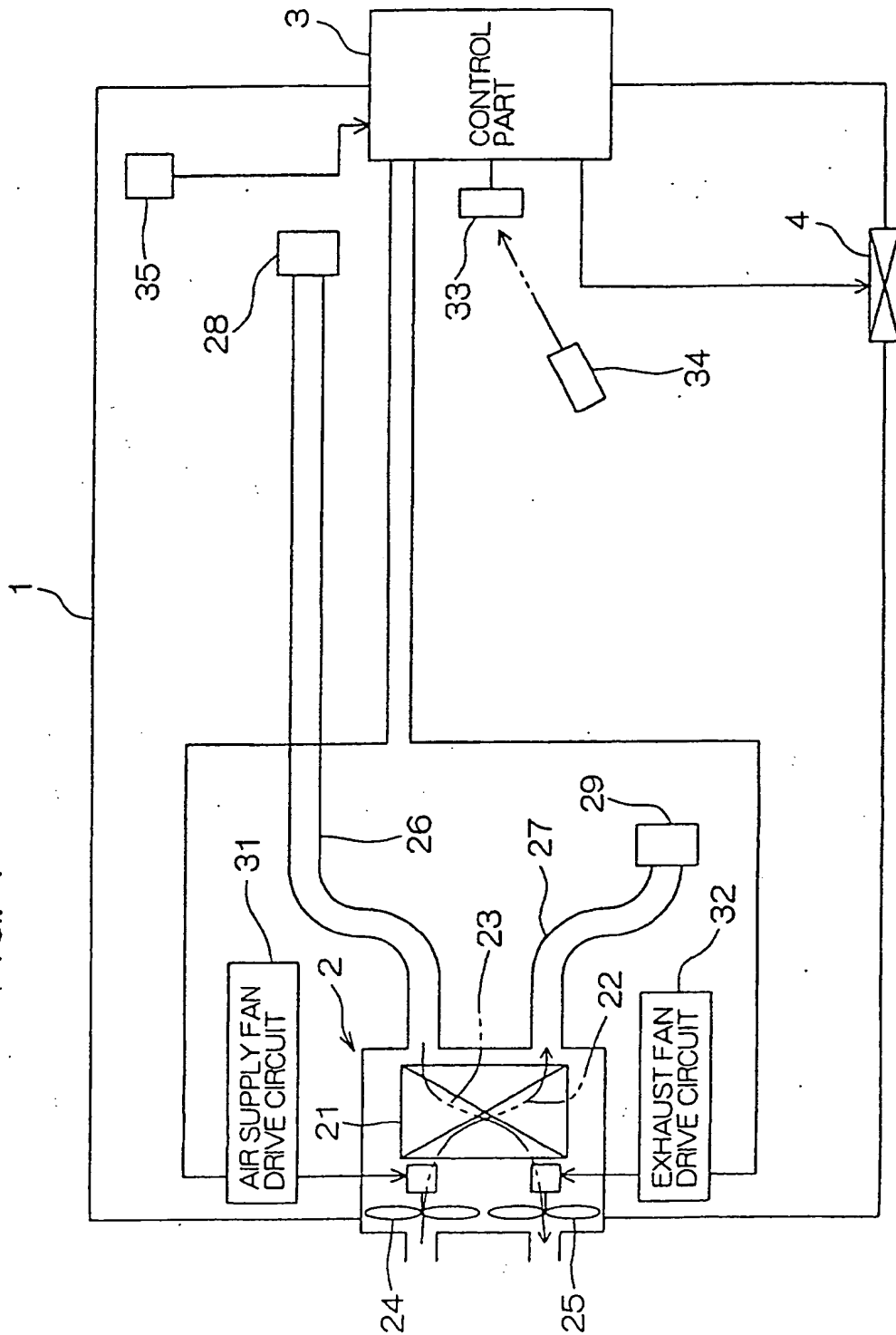


FIG. 2

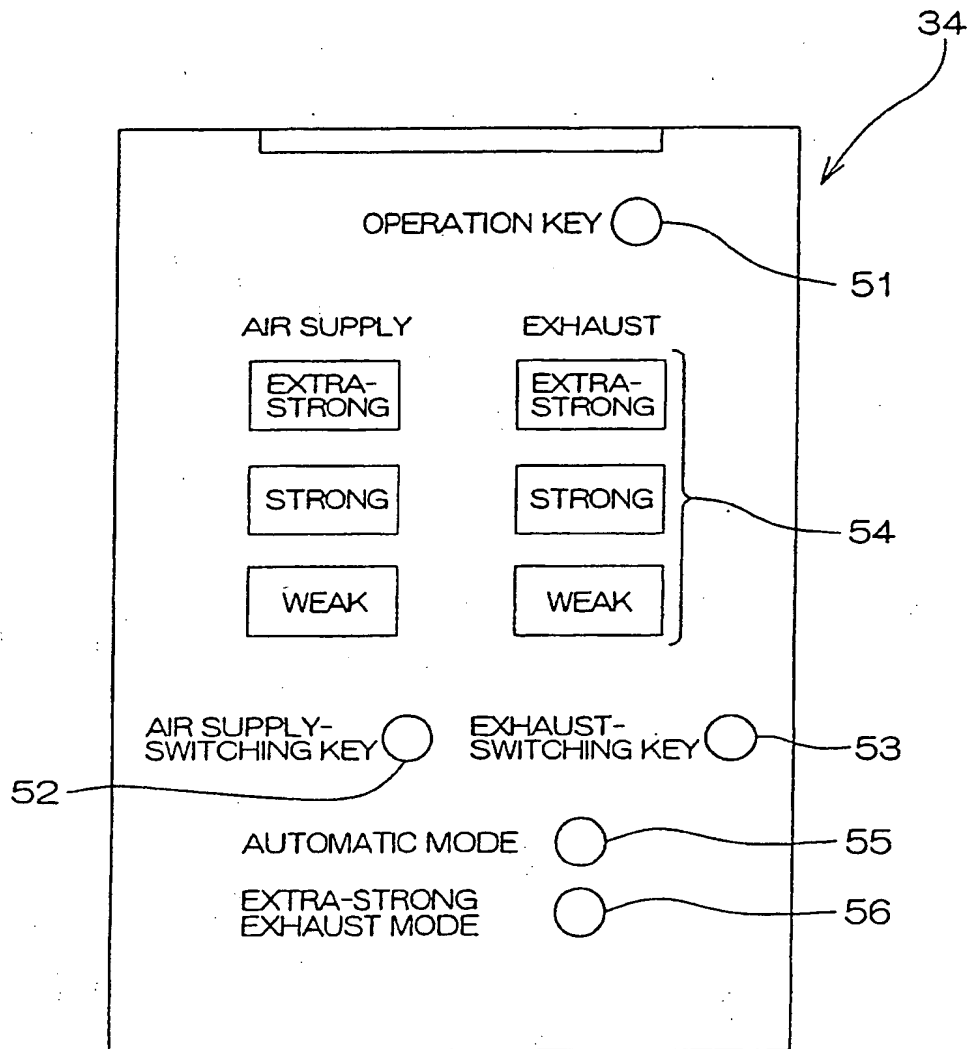


FIG. 3

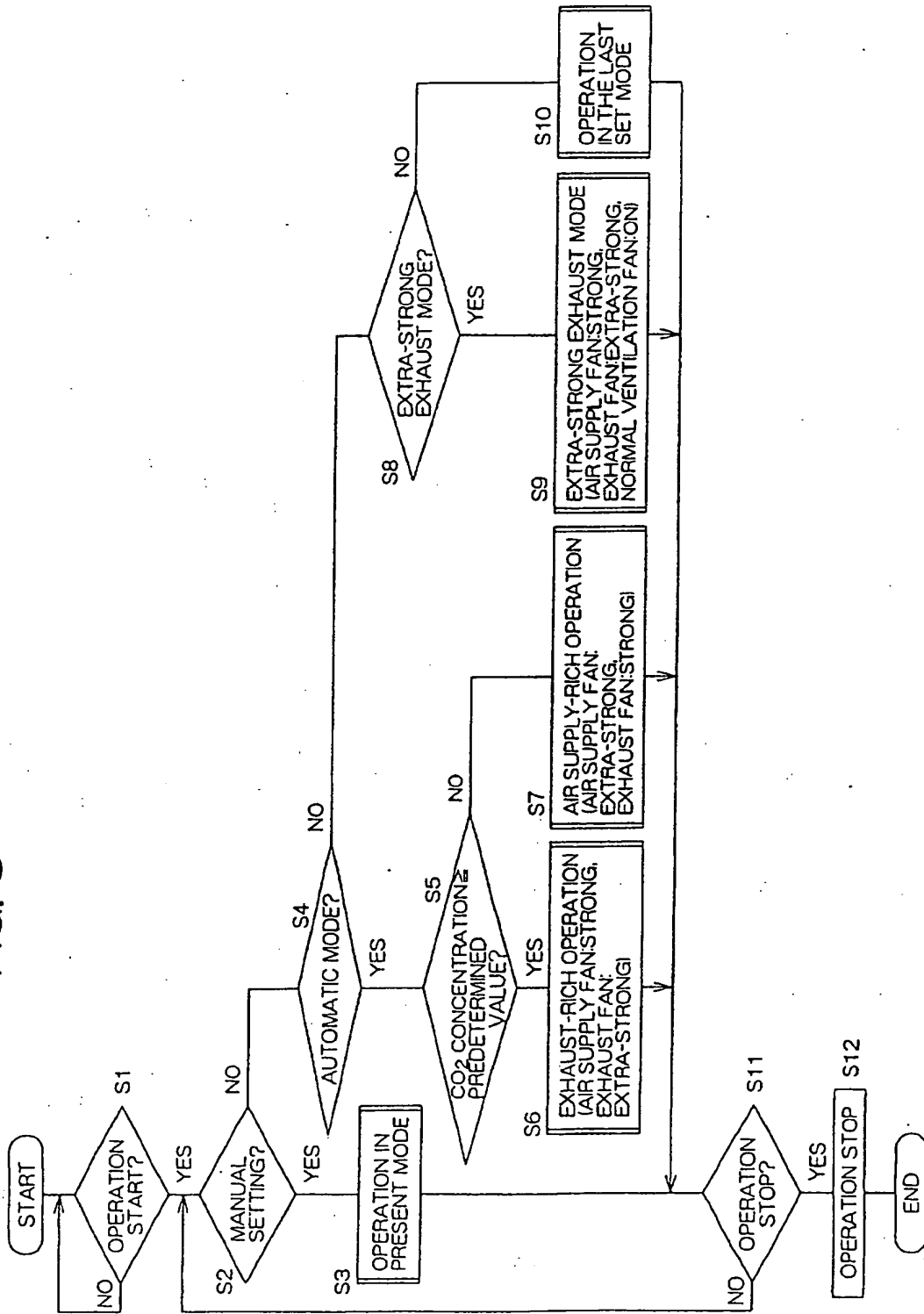
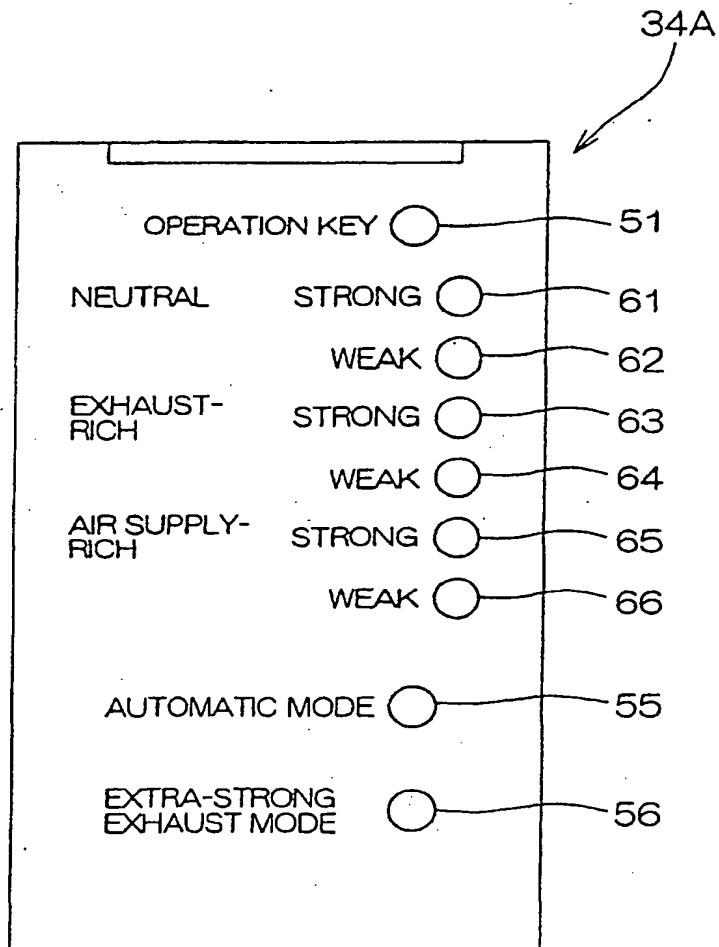


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/04997

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl.⁶ F24F7/08, F24F11/02, F24F11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl.⁶ F24F7/08, F24F11/02, F24F11/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1926-1999 Toroku Jitsuyo Shinan Koho 1994-1999

Kokai Jitsuyo Shinan Koho 1971-1999

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 06-123469, A (Hitachi, Ltd.), 06 May, 1994 (06.05.94), Full text; Figs. 1 to 17 (Family: none)	1
Y	JP, 10-9634, A (Mitsubishi Electric Corporation), 16 January, 1998 (16.01.98), Full text; Figs. 1 to 5 (Family: none)	2-13
Y	JP, 61-49949, A (Matsushita Seiko Co., Ltd.), 12 March, 1986 (12.03.86), Full text; Figs. 1, 2 (Family: none)	4-6
Y	JP, 62-26434, A (Mitsubishi Electric Corporation), 04 February, 1987 (04.02.87), Full text; Figs. 1 to 7 (Family: none)	4-6, 8
Y	JP, 7-19574, A (Fujita Corporation), 20 January, 1995 (20.01.95), Full text; Fig. 1 (Family: none)	7
Y	JP, 7-19574, A (Fujita Corporation), 20 January, 1995 (20.01.95), Full text; Fig. 1 (Family: none)	9-12

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
03 December, 1999 (03.12.99)Date of mailing of the international search report
21 December, 1999 (21.12.99)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.